4037A

High-Mu Triode

OCTAL-BASED PENCIL TUBE

For RF-Power-Amplifier, Oscillator, and Frequency-Multiplier Applications at Altitudes up to 100,000 Feet Without Pressurization

Replaces Type 2C40A in Most Applications

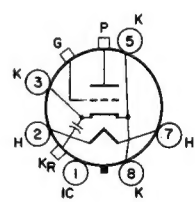
ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.145	A
Cathode Warmup Time to reach 90 percent of		
Typical oscillator power output	10 max	s
Operating dc plate current	15 max	s
Amplification Factor	30	
Transconductance for dc plate mA = 18 and dc plate volts = 250	5500	μmhos
Direct Interelectrode Capacitances (Approx.)		
Grid to plate	1.1	pF
Grid to cathode	1.8	pF
Plate to cathode	0.05 max	pF
Cathode to rf cathode terminal	100	pF

MECHANICAL

Operating Position . . . . . Any
Maximum Overall Length . . . . . 3.125 in
Maximum Diameter . . . . . 1.312 in
Base . . .Small H-Wafer Octal 6-Pin (JEDEC Group 1, No.B6-108)
Terminal Connections BOTTOM VIEW

Pin 1 – Do Not Use
Pin 2 – Heater
Pin 3 – Cathode
Pin 5 – Cathode
Pin 7 – Heater
Pin 8 – Cathode
K_R – Cathode rf terminal (Cylinder adjacent to base)
G – Grid (Flange between insulator sections)
P – Plate (Cylinder adjacent to upper insulator section)



THERMAL

Plate Seal Temperature . . . . . 175 max °C

CLASS A_1 RF AMPLIFIER

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	300	V
DC Grid Voltage	-100	V
DC Plate Current	25	mA

Plate Dissipation[a]	6.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Maximum Circuit Value

Grid-Circuit Resistance	0.5	MΩ

RF POWER AMPLIFIER AND OSCILLATOR — CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation[b]

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	360	V
DC Grid Voltage	-100	V
DC Plate Current	25	mA
DC Grid Current	8	mA
Plate Input	9	W
Plate Dissipation[a]	6.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Typical CCS Operation

As oscillator in cathode-drive circuit

	At 500	2000	3000	Mc/s
DC Plate-to-Grid Voltage	262	252	252	V
DC Cathode-to-Grid Voltage[c]	12	2	2	V
DC Plate Current	23	23	25	mA
DC Grid Current (Approx.)	6	3	4	mA
Useful Power Output (Approx.)	3	0.45	0.1	W

As rf power amplifier in cathode-drive circuit at 500 Mc/s

DC Plate-to-Grid Voltage	326	V
DC Cathode-to-Grid Voltage[c]	51	V
DC Plate Current	23	mA
DC Grid Current (Approx.)	7	mA
Driver Power Output (Approx.)	2	W
Useful Power Output (Approx.)	5	W

Maximum Circuit Value

Grid-Circuit Resistance	0.1	MΩ

PLATE-MODULATED RF POWER AMPLIFIER — CLASS C TELEPHONY

Carrier conditions per tube for use with a max modulation factor of 1

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	275	V
DC Grid Voltage	-100	V
DC Plate Current	22	mA
DC Grid Current	8	mA

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Plate Input	6	W
Plate Dissipation[a]	4.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Maximum Circuit Value

Grid-Circuit Resistance	0.1	MΩ

CHARACTERISTICS RANGE VALUES

	Note	*Min*	*Max*	
Heater Current	1	0.130	0.160	A
Direct Interelectrode Capacitances				
Grid to plate	-	0.8	1.3	μF
Grid to cathode	-	1.5	2.1	μF
Plate to cathode	-	-	0.05	μF
Heater-Cathode Leakage Current				
Heater negative with respect to cathode	1,2	-	50	μA
Heater positive with respect to cathode	1,3	-	50	μA
Reverse Grid Current	1,4	-	1	μA
Amplification Factor	1,5	22	38	
Transconductance	1,5	4000	7000	μmhos
Plate Current (1)	1,5	13.5	24.5	mA
Plate Current (2)	1,6	-	55	μA
Power Output	1,7	0.15		W

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 100 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With dc plate voltage of 250 volts, dc grid voltage of -2.5 volts, grid resistor of 0.5 megohm.

Note 5: With dc plate-supply voltage of 250 volts, cathode resistor of 200 ohms, and cathode bypass capacitor of 1000 microfarads.

Note 6: With dc plate voltage of 250 volts and dc grid voltage of -25 volts.

Note 7: With dc plate voltage of 250 volts, grid resistor adjusted to give a dc plate current of 25 milliamperes in a cavity-type oscillator operating at 1800 ± 25 megacycles per second.

[a] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the terminal to provide adequate heat conduction.

[b] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

[c] Obtained from grid resistor.

SPECIAL TESTS AND PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test

This test (similar to MIL-E-1D, par. 4.9.12.1) is periodically performed on a sample lot of tubes. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 25,000 feet. Breakdown should not occur when a 60-cycle rms voltage

of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.3 volts, dc plate-supply voltage of 250 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube should not exceed 100 millivolts.

High-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40-60 c/s and acceleration is 10 g. At the end of this test, tubes should not show temporary or permanent shorts or open circuits and should meet the following limits:

Heater-Cathode Leakage Current	**50 max**	μA

For conditions shown under *Characteristics Range Values Notes 1,2 and 1,3.*

Low-Frequency Vibration (rms)	**100 max**	**mV**

For conditions shown above under *Low-Frequency Vibration Performance.*

Transconductance.	**3900 min**	μmhos

For conditions shown under *Characteristics Range Values Notes 1,5.*

Shorts and Continuity Test

This test (similar to MIL-E-1D, par. 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test should be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in par. 4.7.7 of MIL-1-D, Amendment 5.

Glass Seal Fracture Tests

Fracture tests are performed on sample lots of subassemblies during manufacture.

1. Tubes (prior to final assembly) are placed on supports spaced 15/16 ± 1/64 inch apart with the grid flange centered

between these supports. Tubes should withstand gradual application, perpendicular to the tube axis, of a force of 30 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes (prior to final assembly) are held by clamping to the cathode cylinder. Tubes should withstand gradual application of a torque of 12.5 inch-pounds upon the plate terminal without causing fracture of the glass insulation.

Dynamic Life Performance

This test (similar to MIL-E-1D, par. 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc/s under the following conditions:

Heater voltage of 6.3 volts, plate-supply voltage of 300 volts, cathode resistor adjusted to give a dc plate current of 25 mA and value recorded, heater positive with respect to cathode by 100 volts, and plate-seal temperature of 175° C min.

At the end of 500 hours, the tube should not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limit.

Power Output	**0.2 min**	**W**

For conditions shown under *Characteristics Range Values Notes 1, 7.*

OPERATING CONSIDERATIONS

Mechanical

The *maximum plate-seal temperature* of 175° C is a tube rating and is to be observed in the same manner as other ratings. The temperature of the plate seal should be measured on the plate seal. The temperature may be measured with temperature-sensitive paint, such as *Tempilaq*. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y., in the form of a liquid or stick.

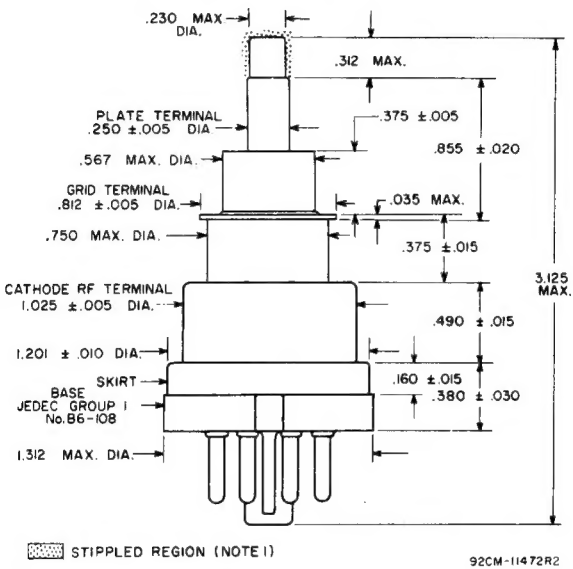
The *mounting* for the 4037A in cavity-type circuits should support the tube by the cathode cylinder which should make firm contact to the cavity surface. Connections to the grid flange and plate cylinder must be made by contacts with flexible leads to allow for variations in tube dimensions and eccentricities of the tube structure. In addition the plate connector should make firm, large-surface contact and be capable of conducting heat so that the plate-seal temperature will not exceed 175° C under any operating conditions. Contact should not be made to the 0.230-inch cap at the plate-terminal end of the tube as indicated on the *Dimensional Outline*.

Electrical

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not

connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these areas.

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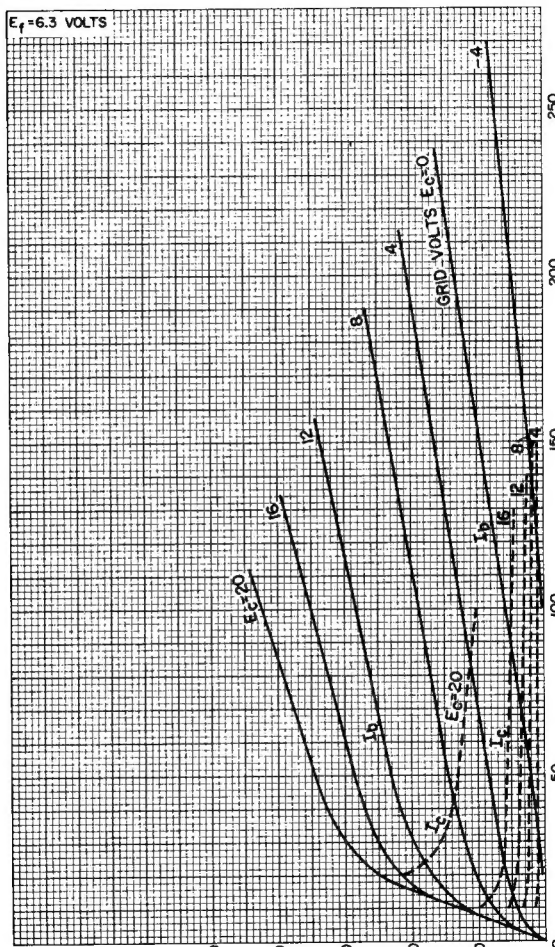
Average Characteristics